METHOD AND APPARATUS FOR PROBABILISTICALLY CLASSIFYING TISSUE IN VITRO AND IN VIVO USING FLUORESCENCE SPECTROSCOPY

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ABSTRACT OF THE DISCLOSURE

Fluorescence spectral data acquired from tissues *in vivo* or *in vitro* is processed in accordance with a multivariate statistical method to achieve the ability to probabilistically classify tissue in a diagnostically useful manner, such as by histopathological classification. The apparatus includes a controllable illumination device for emitting electromagnetic radiation selected to cause tissue to produce a fluorescence intensity spectrum. Also included are an optical system for applying the plurality of radiation wavelengths to a tissue sample, and a fluorescence intensity spectrum detecting device for detecting an intensity of fluorescence spectra emitted by the sample as a result of illumination by the controllable illumination device. The system also include a data processor, connected to the detecting device, for analyzing detected fluorescence spectra to calculate a probability that the sample belongs in a particular classification. The data processor analyzes the detected fluorescence spectra using a multivariate statistical method. The five primary steps involved in the multivariate statistical method are (i) preprocessing of spectral data from each patient to account for inter-patient variation, (ii) partitioning of the preprocessed spectral data from all patients into calibration and prediction sets, (iii) dimension reduction of the preprocessed spectra in the calibration set using principal component analysis, (iv) selection of the diagnostically most useful principal components using a two-sided unpaired student's t-test and (v) development of an optimal classification scheme based on logistic discrimination using the diagnostically useful principal component scores of the calibration set as inputs.

A: 231018(4Y9601!.DOC)